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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/587,062

08/19/2008

Franz Kreupl

I433.236.101/14083

9521

25281

7590

11/23/2011

DICKE, BILLIG & CZAJA

FIFTH STREET TOWERS

100 SOUTH FIFTH STREET, SUITE 2250

MINNEAPOLIS, MN 55402

EXAMINER

DUONG, KHANH B

ART UNIT

PAPER NUMBER

2822

MAIL DATE

DELIVERY MODE

11/23/2011

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/587,062	Applicant(s) KREUPL ET AL.	
	Examiner KHANH DUONG	Art Unit 2822	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 21 September 2011.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ An election was made by the applicant in response to a restriction requirement set forth during the interview on ____; the restriction requirement and election have been incorporated into this action.
- 4) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 5) ☒ Claim(s) 23-45 is/are pending in the application.
- 5a) Of the above claim(s) 41-44 is/are withdrawn from consideration.
- 6) ☐ Claim(s) ____ is/are allowed.
- 7) ☒ Claim(s) 23-33, 37-39 and 45 is/are rejected.
- 8) ☒ Claim(s) 34-36 and 40 is/are objected to.
- 9) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 10) ☐ The specification is objected to by the Examiner.
- 11) ☒ The drawing(s) filed on 21 July 2006 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 12) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 13) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. ____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. ____. |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date <u>7/21/2006</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Election/Restrictions

Applicant's election without traverse of Group I (claims 23-40 and 45) in the reply filed on September 21, 2011 is acknowledged.

Claims 41-44 are withdrawn from further consideration pursuant to 37 CFR 1.142(b) as being drawn to a nonelected invention, there being no allowable generic or linking claim.

Claims 1-22 were previously canceled.

Currently, claims 23-40 and 45 are active.

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Information Disclosure Statement

The information disclosure statement (IDS) submitted on July 21, 2006 has been considered by the examiner.

Specification

The title of the invention is not descriptive. A new title is required that is clearly indicative of the invention to which the claims are directed.

The following title is suggested: SEMICONDUCTOR POWER SWITCH UTILIZING NANOWIRES.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 24 and 33 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Re claim 24, the claim recites “wherein the length of the nanowires is $((0.2 \mu\text{m}) * (\text{maximum value of the voltage (in V) which is applied to the semiconductor power switch}))$ ” in lines 1-3. However, there is insufficient antecedent basis for the limitation “the length” in the claim. In addition, the product $(\mu\text{m} * \text{V})$ of the recited equation above does not equate to a length (e.g., μm) of the nanowires. Thus, it is unclear and confusing what is being claimed by the equation.

Re claim 33, the claim recites the limitation “the gate bands” in line 2. There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

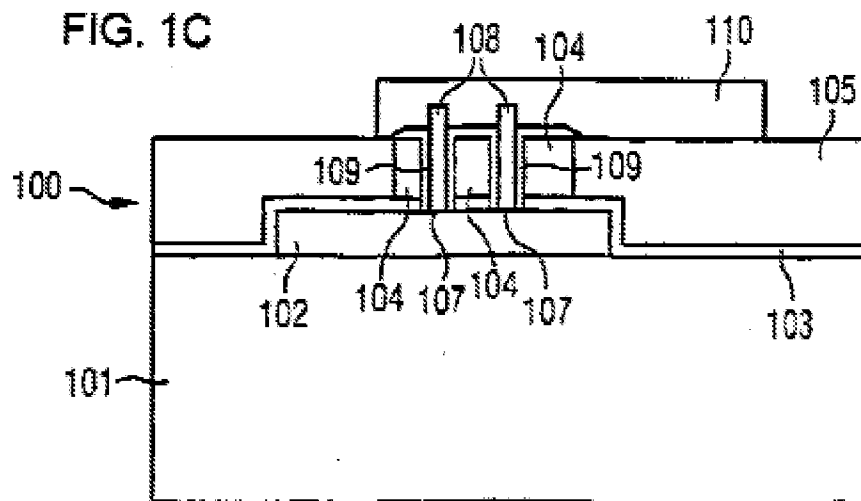
(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 23-33, 37, 38 and 45 are rejected under 35 U.S.C. 102(e) as being anticipated by Roesner et al. (U.S. Patent No. 6,740,910).

Re claim 23, Roesner et al. (“Roesner”) discloses in FIG. 1C a semiconductor power switch comprising: a source contact 102; a drain contact 110; a semiconductor structure provided between the source contact 102 and the drain contact 110; a gate 104 used to control a current

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flow through the semiconductor structure between the source contact and the drain contact; and wherein the semiconductor structure has a plurality of nanowires 108 which are connected in parallel and are arranged in such a manner that each nanowire 108 forms an electrical connection between the source contact 102 and the drain contact 110 [see col. 4, line 60 to col. 6, line 46].



Re claim 24, Roesner discloses the length of the nanowires 108 have a length such that they project beyond the upper surface of the oxidized layer 109 [see col. 6, lines 39-42].

Re claim 25, Roesner expressly discloses in FIG. 1C the gate is implemented in the form of a gate layer 104 which is provided between the source contact 102 and the drain contact 110 and is permeated by the nanowires 108, the nanowires 108 being electrically insulated from the gate layer 104 (by layer 109).

Re claim 26, Roesner expressly discloses in FIG. 1C the gate is implemented in the form of a plurality of gate bands 104 whose longitudinal orientation respectively runs substantially perpendicular to the orientation of the nanowires 108 and whose transverse orientation

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corresponds to the orientation of the nanowires 108, the nanowires 108 being electrically insulated from the gate.

Re claim 27, Roesner expressly discloses in FIG. 1C the nanowires run within trenches 106 provided between the gate bands 104.

Re claim 28, Roesner expressly discloses in FIG. 1B the gate bands 104 and/or trenches 106 are at an equal distance from one another.

Re claim 29, Roesner expressly discloses in FIG. 1C tubes (of material 109) are provided within the trenches 106, at least one nanowire 108 respectively running within the tubes.

Re claim 30, Roesner expressly discloses in FIG. 1C insulation layers 109 are provided between the trenches 106 and the gate bands 104.

Re claim 31, Roesner expressly discloses in FIG. 1C the nanowires 108 are insulated from one another.

Re claim 32, Roesner expressly discloses in FIG. 1C the nanowires are at an equal distance from one another.

Re claim 33, Roesner expressly discloses in FIG. 1C the gate layer (the gate bands) 104 has a layer thickness (band width) which is approximately 1/3 of the distance between the source contact 102 and the drain contact 110.

Re claims 37 and 38, Roesner discloses the nanowires 108 are semiconducting carbon nanotubes or silicon [see col. 2, lines 47-50].

Re claim 45, Roesner et al. ("Roesner") discloses in FIG. 1C a semiconductor power switch comprising: a source contact 102; a drain contact 110; means for providing a semiconductor structure between the source contact 100 and the drain contact 110; a gate 104

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used to control a current flow through the semiconductor structure means between the source contact 102 and the drain contact 110; and wherein the semiconductor structure means has a plurality of nanowires 108 which are connected in parallel and are arranged in such a manner that each nanowire 108 forms an electrical connection between the source contact 102 and the drain contact 110.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later

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invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 39 is rejected under 35 U.S.C. 103(a) as being unpatentable over Roesner in view of Duan et al. (U.S. Patent No. 7,067,867).

Re claim 39, Roesner fails to disclose the nanowires are p-doped or n-doped.

Duan et al. (hereinafter “Duan”) suggests the nanowires are p-doped or n-doped for the purpose of using electrons as conducting carriers to substantially reduce or entirely eliminate phonon scattering of electrons in the nanowires [see col. 4, lines 1-10].

Since Roesner and Duan are from the same field of endeavor, the purpose disclosed by Duan would have been recognized in the pertinent prior art of Roesner.

Therefore, it would have been obvious to a person of ordinary skill in the art at the time the invention was made to modify the device disclosed by Roesner as suggested by Duan because of the desirability to use electrons as conducting carriers to substantially reduce or entirely eliminate phonon scattering of electrons in the nanowires.

Allowable Subject Matter

Claims 34-36 and 40 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

The following US patents disclose relevant teachings regarding nanowires: Xu '682, Kato '184, Frazier '418, Doyle '220, Xu' 201, Goronkin '683, Berger '497 and Chen '606.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Khanh B. Duong whose telephone number is (571) 272-1836. The examiner can normally be reached on Monday-Friday from 8:30-4:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Zandra Smith, can be reached on (571) 272-2429. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Khanh B. Duong/

Examiner, Art Unit 2822

/Zandra V. Smith/

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Supervisory Patent Examiner, Art Unit 2822